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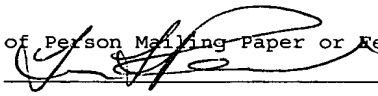
Signature: 

PATENT APPLICATION
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TAPE CARTRIDGE

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TAPE CARTRIDGE

BACKGROUND

[0001] A widely used medium for storing data is magnetic tape. Tape cartridges are one of the most popular formats for storing data on tape. Two widely used tape cartridges are the dual reel cartridge and the single supply reel cartridge. In a dual reel tape cartridge, both the supply reel and the take-up reel are housed in the cartridge. In a single supply reel tape cartridge, the take-up reel is built into the tape drive along with an automatic tape threading mechanism. When a tape cartridge is not in use in a tape drive or tape player, it is possible for the reel(s) to rotate idly and cause the tape to lose tension and become partially unwound from the reel. To avoid this problem, tape cartridges often include some type of reel lock.

[0002] A common type of reel lock used in single supply reel cartridges includes a locking gear that engages teeth or other projections on the back of a reel drive gear that locks the reel when the cartridge is not installed in a tape drive. A spider washer pushes the locking gear out of the way into a disengaged position unlocking the reel when the cartridge is installed in the tape drive. In this disengaged position, the spider washer spins (with the reel) against the stationary locking gear. The spinning washer sometimes makes the locking gear wobble, oscillate up and down or otherwise vibrate within the free play tolerance of the alignment feature that couples the locking gear to the cartridge housing. At the higher tape speeds of some of the newer generation tape drives, the reel lock vibrating against the hard plastic cartridge housing can be noisy. Embodiments of the invention were developed to reduce these noisy vibrations.

DESCRIPTION OF THE DRAWINGS

[0003] Fig. 1 is a perspective bottom side view of a single supply reel tape cartridge.

[0004] Figs. 2 and 3 are cross section perspective views of a single supply reel tape cartridge constructed according to one embodiment of the invention showing the reel lock in the locked and unlocked positions, respectively.

[0005] Fig. 4 is a perspective view of the inside of the top of the housing of the cartridge shown in Figs. 2 and 3.

[0006] Fig. 5 is a top perspective view of reel lock components of the cartridge shown in Figs. 2 and 3.

[0007] Fig. 6 is an exploded perspective view of the components shown in Fig. 4.

[0008] Figs. 7 and 8 are perspective views of reel lock components of the cartridge shown in Figs. 2 and 3 showing the legs of the spider washer in the locked and unlocked position, respectively.

[0009] Figs. 9 and 10 are perspective views showing reel lock and motion damping components of a tape cartridge constructed according to a second embodiment of the invention.

[0010] Figs. 11 and 12 are perspective views showing reel lock and motion damping components of a tape cartridge constructed according to a third embodiment of the invention.

[0011] Figs. 13 and 14 are perspective and section views, respectively, showing reel lock and motion damping components of a tape cartridge constructed according to a fourth embodiment of the invention.

[0012] Fig. 15 is a detail view of one embodiment of a damper portion of the components shown in Figs. 13 and 14.

[0013] Fig. 16 is a detail view of another embodiment of a damper portion of the components shown in Figs. 13 and 14.

DESCRIPTION

[0014] Referring to Figs. 1-3, a single reel tape cartridge 10 includes a housing 12 and a tape supply reel 14. Housing 12 is a rectangular box-like structure configured to enclose a single reel of tape. Housing 12 is usually formed of plastic molded into two segments -- a cover segment 18 and a base segment 20. The tape is accessible to a tape drive through an access window 24. A door 26 covers access window 24 when cartridge 10 is not installed in a tape drive.

[0015] Referring to Figs. 2 and 3, tape reel 14 includes disc shaped top and bottom flanges 28 and 30 and an annular hub 32. A circular reel gear 34 is positioned at the bottom of hub 32. Reel gear 34 is the operative interface between a tape drive and the tape reel. Reel gear 34 is engaged by a mating coaxial gear in the drive mechanism of a tape drive. Reel gear 34 is accessed by the tape drive through an opening 36 in the base 20 of housing 12.

[0016] Referring now to Figs. 2-8, reel lock 38 includes a spider washer 40, a locking gear 42 and locking posts 44 positioned at spaced apart locations around the top of reel gear 34. The ends 46 of locking posts 44 are sized and shaped to fit into locking gear teeth 48. Three locking posts 44 spaced at equal intervals around reel gear 34 are just one example of a suitable structure for the operative engagement between locking gear 42 and reel gear 34. Other examples include a full or partial set of gear teeth on the top of reel gear 34 instead of the posts used in the embodiment shown in Figs. 2-8 or, instead of using a locking gear 42, this locking member could be constructed as a flat disk having one or more posts projecting down to engage teeth on top of the reel gear.

[0017] Legs 50 of spider washer 40 project through holes 52 in reel gear 34. Holes 52 are positioned at the gaps 54 between reel gear teeth 56 as best seen in Figs. 6-8. Spider legs 50 project into gaps 54 between reel gear teeth 56, as best seen in Fig. 7. Preferably, each hole 52 and correspondingly each spider leg 50 spans the gap 54 between adjacent gear teeth to prevent jamming in the teeth of the tape drive gear. Each hole 52 and spider leg 50 could also be made to span two or more gaps 54, in which case hole 52 would extend through one or more gear teeth.

[0018] Locking gear 42 is movable in only one dimension, along the axis of rotation of reel 14. Locking gear 42 is nominally fixed in the other dimensions by an alignment feature 57 that couples gear 42 to cartridge housing 12. In the embodiment shown in Figs. 2-8, alignment feature 57 includes an insert 58 formed on or integral with cover segment 18 of housing 12 and a mating receiver 60 formed on or integral with the top 62 of locking gear 42. In this embodiment, insert 58 is constructed as a ridge on housing cover 18. Receiver 60 on locking gear 42 receives ridge 58 on cartridge housing 12 to align locking gear 42 over spider washer 40 and locking posts 44. A biasing spring 64 between cartridge housing 12 and locking gear 42 urges locking gear 42 against spider washer 40 and locking posts 44. This biasing mechanism 64 pushes spider legs 50 down into reel gear teeth 56 and keeps reel lock 38 locked when tape cartridge 10 is not installed in a tape drive. A damper 65 is interposed between locking gear 42 and housing 12. In the embodiment shown in Figs. 2-8, damper 65 is constructed as a resilient pad 66 surrounding slot 60 on locking gear 42. Resilient pad 66 is slightly deeper than receiver 60 so that pad 66 protrudes above receiver 60.

[0019] In operation, as the drive motor gear in a tape drive engages reel gear 34, the tips of the drive motor gear push on spider legs 50 to drive spider washer 40 up into reel gear 34. This action moves locking gear 42 up and off locking posts 44 to unlock reel lock 38, as best seen by comparing Figs. 2 and 3 and Figs. 7 and 8. Spider washer 40 and biasing spring 64 serve as the actuator for reel lock 38. Spider washer 40 acts as a release mechanism to disengage the locking member, locking gear 42 in this embodiment, from reel 14 and unlock reel lock 38 when the tape drive engages the reel 14. Spring 64 serves as a biasing mechanism to urge the locking member, locking gear 54, towards the locked position. When locking gear 42 is pushed up to the unlocked position, shown in Figs. 3 and 8, resilient pad 66 is driven into contact with housing 12 at the area surrounding ridge 58 as ridge 58 slides deeper into receiver 60. Thus, while reel lock 38 is in the unlocked position, resilient pad 66 is pressed between locking gear 62 and housing 12 to dampen any vibration in locking gear 62 and insulate housing 12 against any such vibration.

[0020] It is desirable that spider legs 50 project out flush with the tips 68 of reel gear teeth 56 to maximize the vertical travel of locking gear 42 when reel gear 34 is engaged by the tape drive. The depth of locking gear teeth 48 should be slightly less than the depth of reel gear teeth 56 (or less than the distance spider legs 50 project into gaps 54 in reel gear teeth 56 if less than the full depth of the teeth) to ensure locking gear 42 clears locking posts 44 to fully release the lock 50. Forces are transmitted between locking gear 42 and spider washer 40 through a button 70 on the bottom 72 of locking gear 42. The frictional interface/bearing surface between spider washer 40 (which rotates with tape reel 14) and locking gear 42 (which is rotationally fixed to cartridge housing 12) occurs at button 70. The frictional interface at button 70 is at the center of rotation of the reel so the radius of button 70 can be made relatively small to minimize frictional drag and wear.

[0021] Figs. 9-10 and 11-12 illustrate alternative configurations for alignment feature 57 and the associated damper 65. Referring first to Figs. 9 and 10, the alignment feature includes a hub 74 and a projecting insert 76 on cover segment 18 of housing 12 and a mating receiver 78 on top 62 of locking gear 42. In this embodiment, insert 76 is constructed as raised spokes on housing cover 18 and the damper is constructed as disc shaped resilient pads 80 affixed to housing 12 between spokes 76. When locking gear 42 is pushed up to the unlocked position,

receiver 78 is driven into contact with pads 80 as spokes 76 slide deeper into receiver 80. Thus, while reel lock 38 is in the unlocked position, resilient pads 80 are pressed between locking gear 42 and housing 12 to dampen any vibration in locking gear 62 and insulate housing 12 against any such vibration.

[0022] Referring to Figs. 11 and 12, the alignment feature includes insert 82 on cover segment 18 of housing 12 and a mating receiver 84 on top 62 of locking gear 42. In this embodiment, insert 82 is constructed as intersecting ridges on housing cover 18 and the damper is constructed as a disc shaped resilient pad 86 affixed to housing 12 surrounding ridges 82. When locking gear 42 is pushed up to the unlocked position, receiver 84 is driven into contact with pad 86 as ridges 82 move deeper into receiver 84. Thus, while reel lock 38 is in the unlocked position, resilient pad 86 is pressed between locking gear 42 and housing 12 to dampen any vibration in locking gear 62 and insulates housing 12 against any such vibration.

[0023] Referring to Figs. 13-16, alignment feature 57 includes the ridge type insert 58 and mating receiver 60 of Figs. 2-8, but damper 65 consists of a resilient pad 88 affixed to or integral with the outside of ridge 58. In one embodiment, shown in the detail view of Fig. 15, resilient pad 88 is formed from a bristling material lining the outside of ridge 58. In another embodiment, shown in the detail view of Fig. 16, resilient pad 88 is formed as a multitude of tiny fingers molded along the outside of ridge 58. In these embodiments, pad 88 creates a light resilient interference fit between ridge 58 and receiver 60 to dampen any vibration in locking gear 62 and insulate housing 12 against any such vibration.

[0024] Although it is expected that resilient pads 66, 80 and 86 will typically be formed from rubber or another suitable elastomeric material, any resilient material that provides the necessary or desired damping may be used. "Teeth" means any sharp angled, rounded or other combination of protrusions and indentations.

[0025] The present invention has been shown and described with reference to the foregoing exemplary embodiments. It is to be understood, however, that other forms, details, and embodiments may be made without departing from the spirit and scope of the invention which is defined in the following claims.